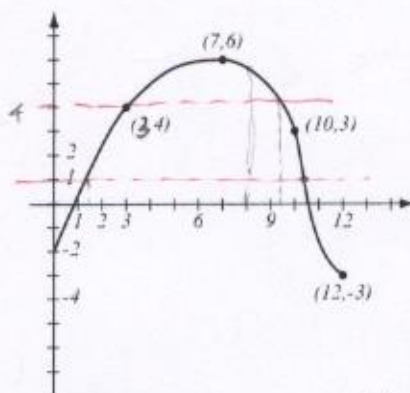


1. (8pts) Use the graph for the water level of a lake over 12 months (in feet above or below a certain mark) to answer the following questions.

- Find the water level at 0 and 8 months.
- At what times was the water level 4 ft?
- When was the water at its highest level? What was the highest water level?
- At what times was the water below 1 ft?



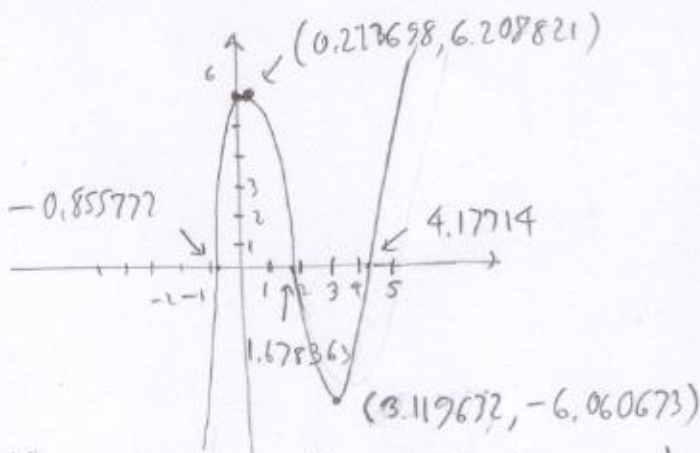
a)  $t=0$   $t=8$   $h) \Delta t = 3$   
 $l=-2$   $l=5.5$  and  $t=9.3$

c) highest level at  $t=7$   
 highest level was 6

d)  $[0, 1.5]$  or  $[10.5, 12]$   
 $0 \leq t \leq 1.5$  or  $10.5 \leq t \leq 12$

2. (14pts) The equation  $y = x^3 - 5x^2 + 2x + 6$  is given.

- Use your calculator to accurately its graph. Draw the graph here, and indicate units on the axes.
- Find all the  $x$ - and  $y$ -intercepts (accuracy: 6 decimal points).
- Find the peaks and valleys of the graph (accuracy: 6 decimal points).



a)  $x$ -int:  $-0.855772, 1.678363, 4.177140$   
 $y$ -int: 6

c) peak:  $(0.213698, 6.208821)$   
 valley:  $(3.119632, -6.060673)$

3. (8pts) Find the  $x$  and  $y$  intercepts of the graph of the equation  $x^2 + y^2 - 4x - 2y + 1 = 0$

$x$ -int:

$y=0$

$x^2 - 4x + 1 = 0$

$$x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4 \cdot 1 \cdot 1}}{2 \cdot 1}$$

$$= \frac{4 \pm \sqrt{12}}{2} = \frac{4 \pm 2\sqrt{3}}{2} = 2 \pm \sqrt{3}$$

$y$ -int:

$x=0$

$y^2 - 2y + 1 = 0$

$(y-1)^2 = 0$

$y=1$

4. (10pts) Find the equation of the line (in form  $y = mx + b$ ) that is parallel to the line  $3x - 2y = 4$ , and passes through point  $(2, -1)$ . Draw both lines.

$$3x - 2y = 4$$

$$2y = 3x - 4 \quad | \div 2$$

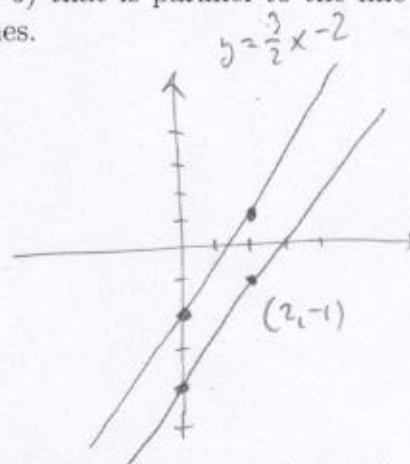
$$y = \frac{3}{2}x - 2$$

Line through  $(2, -1)$ ,  
slope =  $\frac{3}{2}$

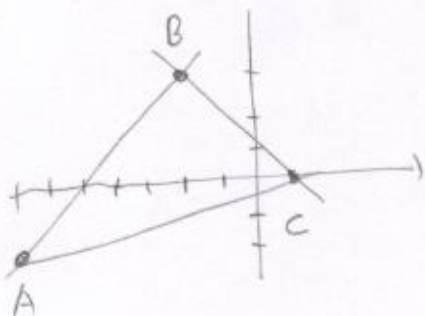
$$y - (-1) = \frac{3}{2}(x - 2)$$

$$y + 1 = \frac{3}{2}x - 3$$

$$y = \frac{3}{2}x - 4$$



5. (8pts) Use slopes of lines to find out whether the triangle with vertices  $A = (-6, -2)$ ,  $B = (-2, 3)$  and  $C = (1, 0)$  is a right triangle.



$$m_{AB} = \frac{3 - (-2)}{-2 - (-6)} = \frac{5}{4}$$

$$m_{BC} = \frac{0 - 3}{1 - (-2)} = -1$$

$$m_{AC} = \frac{0 - (-2)}{1 - (-6)} = \frac{2}{7}$$

None of these is  
the opposite reciprocal  
of another, so no two  
sides are perpendicular

6. (12pts) The number of students enrolled at MSU increased from 10,025 in 2008 to 10,832 in 2013.  $x=5$   $x=0$

- a) Assuming the number of students grows in a linear fashion, write the equation expressing the number of students  $y$  in terms of number of years  $x$  since 2008.  
b) What number of students does your equation predict for 2016?  
c) When does the equation predict MSU will have 12,000 students?

a) Need a line through  
 $(0, 10,025)$  and  $(5, 10,832)$

$$m = \frac{10,832 - 10,025}{5 - 0} = \frac{807}{5} = 161.4$$

$$y - 10,025 = 161.4(x - 0)$$

$$y = 161.4x + 10,025$$

b)  $x=8, y = 161.4 \cdot 8 + 10,025 = 11,316.2$

About 11,316 students

c)  $161.4x + 10,025 = 12,000 \quad | -10,025$

$$161.4x = 1975 \quad | \div 161.4$$

$$x = 12.236679 \quad x \approx 12$$

so in about 2020.